REMARKS

Claims 1-18 and 21 are currently pending. Claims 19 and 20 have been cancelled. New claim 21 has been added. Applicants submit that support for new claim 21 can be found at page 8, ¶1 of the Specification and in Figures 3-8.

Applicants thank the Examiner for the withdrawal of the objection to claim 1 and the withdrawal of the rejections under 35 U.S.C. § 112. Applicants respectfully request reconsideration of the above-identified application in view of the above amendments and the following remarks.

Rejections Under 35 U.S.C. § 102(b) and § 103(a)

3. Claims 1-2, 8 and 14 are rejected under 35 U.S.C. 102(b) as being anticipated by Bertrand et al., U.S. Patent No. 5,125,453. Specifically, the Examiner has stated that the angle γ is read as zero or 180 degrees in that reference. Claims 9-10 and 17-18 are also rejected under 35 U.S.C. § 103(a) as obvious over Bertrand et al.. Applicants respectfully traverse the rejections.

Applicants' have amended claim 1 to recite that "each surface structure" comprises "at least one row of ***elongate directing elements***" that are "***arranged obliquely with respect to the longitudinal direction of the primary surfaces***." Support for this claim can be found, inter alia, in Applicants' Figure 4.

An example of these features not intended to affect the scope of the claims can be seen in Applicants' Figure 4. The directing elements that make up the surface structures in Figure 4 are arranged obliquely with respect to the flow. An "oblique arrangement" requires that

the elongate directing elements be placed in such a way that they are neither parallel nor perpendicular to the flow.

In contrast, Bertrand et al. discloses a plate for use in a plate-fin heat exchanger, including a plurality of beads arranged in rows. Unlike the obliquely arranged directing elements of Applicants' amended claim 1, the slightly elongated "beads" in Bertrand are arranged in the direction of the flow. This arrangement, by definition, is not oblique, as is required by claim 1, as amended. Therefore, Bertrand et al. cannot anticipate claims 1-2, 8 and 14 because it does not teach every element of those claims. See MPEP § 2131, p. 2100-54 (*quoting* Verdegaal Bros. v. Union Oil Co. of California, 814 F.2d 628, 631 (Fed. Cir. 1987) ("[a] claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference")). Since dependent claims 2, 8 and 14 all depend directly from claim 1, they also cannot be anticipated by these references. See MPEP § 2131, p. 2100-54.

"To establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art." MPEP § 2143.03 (citing In re Royka, 490 F.2d 981, 180 USPQ 580 (CCPA 1974)). Since Bertrand et al. does not anticipate claim 1, it cannot render it obvious. Id. Moreover, any rejection of claim 1, as amended, under 35 U.S.C. § 103 would be improper since there is no teaching or suggestion for arranging the beads obliquely in Bertrand et al. at all, let alone to achieve the parallel spiral flows that the structure of amended claim 1 produces. Since the claimed structure of amended claim 1 patentably distinguishes over Bertrand et al., claims 9-10 and 17-18 also distinguish over this reference because they depend from claim 1. Applicants therefore respectfully request that the rejections under 35 U.S.C. §102(b) and 35 U.S.C. §103(a) with respect to Bertrand et al. be withdrawn.

4. Claims 1-2, 8, 11-12 and 14 are rejected under 35 U.S.C. 102(b) as being anticipated by Kamiya, Japanese Document No. 1-142393. Specifically, the Examiner has stated that the angle γ is read as zero or 180 degrees in that reference. Claims 9-10 and 17-18 are also rejected under 35 U.S.C. § 103(a) as obvious over Kamiya. Applicants respectfully traverse the rejections.

Applicants' have amended claim 1 to recite that "each surface structure" comprises "at least one row of ***elongate directing elements***" that are "***arranged obliquely with respect to the longitudinal direction of the primary surfaces***." Claim 1 has also been amended to recite that the surface structures are "alternatingly arranged in the longitudinal direction on the first and second primary surfaces." Support for this claim can be found, inter alia, in Applicants' Figure 4.

An example of these features not intended to affect the scope of the claims can be seen in Applicants' Figure 4. Figure 4 discloses how the surface structures are alternatingly arranged on each of the first and second primary surfaces, wherein directing elements on one primary surface are indicated in solid lines, while alternating structures on the opposite primary surface are indicated in broken lines. As discussed above in the preceding section, Figure 4 also shows how the elongate directing elements are arranged obliquely to the flow, that is, they are neither fully parallel to the flow, nor fully perpendicular to it.

In contrast, Kamiya discloses a tube of a heat exchanger having mutually opposing flat side surfaces 101, 102 containing two rows of a plurality of protuberance 2a, 2b projected inwardly at the inside surface of the tube 1 formed on the second flat side surface 102. Kamiya does not disclose placing the protuberance on both sides 101, 102 as required by claim 1, as amended. Moreover, since Kamiya only discloses placing the protuberance on one side, Kamiya does not disclose, teach, or suggest placing the protuberance on each surface in an

alternating fashion, as is also required by claim 1. Finally, Kamiya only appears to place the protuberance perpendicularly to the flow direction, not obliquely, as is also required by claim 1.

Kamiya therefor cannot anticipate claim 1 because it does not teach every element of that claim. See MPEP § 2131, p. 2100-54 (*quoting* Verdegaal Bros. v. Union Oil Co. of California, 814 F.2d 628, 631 (Fed. Cir. 1987) ("[a] claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference")). Since dependent claims 2, 8, 11-12 and 14 all depend directly from claim 1, they also cannot be anticipated by these references. See MPEP § 2131, p. 2100-54. Applicants therefore respectfully request that the rejection under 35 U.S.C. 102(b) with respect to Kamiya be withdrawn.

Moreover, "[t]o establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art." MPEP § 2143.03 (citing In re Royka, 490 F.2d 981, 180 USPQ 580 (CCPA 1974)). As discussed above, since Kamiya does not disclose, teach or suggest all of the features of claim 1, as amended, claim 1 cannot be obvious over Kamiya. Claims 9-10 and 17-18 also patentably distinguish over Kamiya because they depend either directly or indirectly from claim 1. Applicants' respectfully request for the rejections under 35 U.S.C. § 102(b) and 35 U.S.C. § 103(a) based on Kamiya to be withdrawn.

5. Claims 1-2, 7-8, and 11-14 have been rejected under 35 U.S.C. § 102(b) as being anticipated by Rhodes, U.S. Patent No. 4,470,452. Claims 9-10 and 17-18 are rejected under 35 U.S.C. § 103(a) as obvious over Rhodes. Specifically, the Examiner has referred to Figure 7C in Rhodes. Applicants respectfully traverse the rejections.

Applicants' have amended claim 1 to recite that the "longitudinal primary heat-exchange surfaces" are ***substantially planar***. Claim 1 has also been amended to recite that the surface structures are "alternatingly arranged in the longitudinal direction" such that the

"directing elements in each laterally extending row of each surface structure" are ***parallel*** to the directing elements in "the ***succeeding row*** of the ***succeeding surface structure*** on the ***opposing primary surface*** in the ***longitudinal direction***." Support for this claim can be found, inter alia, in Applicants' Figure 4.

An example of these features not intended to affect the scope of the claims can be seen in Applicants' Figure 4. The surface structures in Figure 4 each comprise two laterally extending rows of elongate directing elements. The directing elements in the surface structures on one of the ***primary surfaces*** are indicated by ***solid lines***, while the directing elements on the ***opposing primary surface*** are indicated in ***dashed lines***. In Figure 4, the elongate directing elements in each of the rows in the surface structures are parallel to the directing elements in "the succeeding row of the succeeding surface structure on the opposing primary surface in the longitudinal direction," as is required by claim 1.

In contrast, while Rhodes discloses an arrangement of elongate "indentations" in a "herringbone" pattern in Fig. 7C, it does not disclose the spatial relationship of the "indentations" on one primary surface with respect to "indentations" on the other primary surface. That is to say, based on the disclosure of Rhodes, it is impossible to tell whether the elongate "indentations" in a given row on a given ***primary surface*** are ***parallel*** to the "indentations" in "the succeeding row of the succeeding surface structure on the ***opposing primary surface*** in the longitudinal direction," as is required by claim 1.

Moreover, the teachings that Rhodes does provide on this issue are deficient to teach or suggest this feature of Claim 1. On this issue, Rhodes states that:

> It should be kept in mind that it is ***not necessary*** to space barriers on the first principal heat transfer surface and the second principal heat transfer surface ***in a staggered relationship***, although this is preferred. ***The barriers may be placed one below the other***.

See Rhodes, Col. 6, lines 15-20 (emphasis added). Applicants' disclosure demonstrates that the alternating placement of surface structures on each primary surface of the tube and the arrangement of the elongate directing elements within those structures is critical in generating the "spiral flow" that contributes to the improved heat transfer of the invention. Rhodes, in contrast, specifically teaches against Applicants' disclosure in stating that it makes no difference how the "turbulator barriers" are arranged. Applicants respectfully submit that this teaching of Rhodes would not lead one skilled in the art to arrive at Applicants' invention as claimed in claim 1. As can be seen, the arrangement of surface structures and the directing elements therein are not mere "matters of design choice," since significant changes in placement of the surface structures in this case would not permit the spiral flow produced by the structure claimed in claim 1. Modifying Rhodes to function as Applicants' invention would require the particular placement of surface structures and directing elements as taught by Applicants. An obviousness rejection on this basis would be improper because, inter alia, it would require changing the basic principle under which Rhodes operates (basic fluid turbulence). See MPEP § 2143.01, p. 2100-99 (citing In re Ratti, 270 F.2d 810, 123 USPQ 349 (CCPA 1959)).

Applicants' disclosure also teaches that the motivation to make the surface structures from discrete elongate elements (as opposed to continuous structures) is to decrease the pressure drop over the length of a tube. This permits enhanced heat transfer from the spiral flow at very low flow-rates, which is especially advantageous since even an engine that is at idle speed can dissipate heat very efficiently. Rhodes teaches that:

> The ***entire purpose*** for making the turbulator barriers **150** ***discontinuous across the principal heat transfer surfaces*** **120** and **122** is so that when the surfaces are being formed into the turbulator radiator tube... the principal heat transfer surfaces may be bowed outward from the interior of the tube to give a slight crown to both of the principal heat transfer surfaces.

See Rhodes Col. 5, lines 37-44 (emphasis added). Rhodes therefore teaches that the entire purpose for breaking up the turbulator barriers into discrete segments is to permit the crowning of the primary heat transfer surfaces, which enhances structural integrity. Rhodes fails to disclose, teach or suggest Applicants' motivation to arrange surface structures and directing elements to achieve multiple spiral flows while maintaining a low pressure drop over the length of a tube.

Finally, Rhodes does not disclose "substantially planar" primary heat transfer surfaces, as is also required by Claim 1. The invention in Rhodes is a radiator tube that has primary heat transfer surfaces that are bowed outwardly to give a slight crown to those surfaces. The stated advantage of this feature in Rhodes is that the crowning of the tube "permits [the tube] to also take up tolerances when it is brought into an assembled condition." See Rhodes, Col. 5, lines 48-51. This further teaches away from the invention recited in Applicants' claim 1.

Applicants respectfully submit that Rhodes cannot anticipate claim 1 because it does not teach every element of that claim as shown above. See MPEP § 2131, p. 2100-54 (*quoting* Verdegaal Bros. v. Union Oil Co. of California, 814 F.2d 628, 631 (Fed. Cir. 1987) ("[a] claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference")). Since claims 2-8, 11-16, and 19 depend either directly or indirectly from claim 1, they, too, cannot be anticipated by Rhodes.

Also, "[t]o establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art." MPEP § 2143.03 (citing In re Royka, 490 F.2d 981, 180 USPQ 580 (CCPA 1974)). As discussed above, since Rhodes does not disclose, teach or suggest all of the features of claim 1, as amended, claim 1 cannot be obvious over Rhodes. Claims 9-10 and 17-18 also patentably distinguish over Rhodes because they

depend either directly or indirectly from claim 1. Applicants' respectfully request for the rejections under 35 U.S.C. § 102(b) and 35 U.S.C. § 103(a) based on Rhodes to be withdrawn.

CONCLUSION

For these reasons, it is believed that all of the claims as presently amended, are patentable, and that this application is in allowable condition.

Respectfully submitted,

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APPENDIX 1

(Version With Markings To Show Changes Made In The Specification)

IN THE CLAIMS

Please amend claims 1, 3 and 19 as follows:

1. (Twice Amended) A fluid conveying tube for vehicle coolers, which on its [inside] interior comprises first and second [opposite] opposing longitudinal primary heat-exchange surfaces, said surfaces being substantially planar and having flow-directing surface structures, each surface structure extending laterally across said primary surfaces, each surface structure comprising at least one row of elongate directing elements, said elongate directing elements being arranged obliquely with respect to the longitudinal direction of the primary surfaces, said elongate directing elements in each row being mutually parallel, [which are arranged on the primary surfaces and which each comprise a plurality of elongate directing elements projecting from the primary surfaces, the] said surface structures being alternatingly arranged in the longitudinal direction on the first and second primary surfaces, the [in such manner that] directing elements in each laterally extending row of each surface structure being parallel to the directing elements in the succeeding row of the succeeding surface structure on the opposing primary surface [, succeeding] in the longitudinal direction [of the primary surfaces, are alternatingly arranged on the first and second primary surfaces and are mutually inclined at a given angle (γ), wherein each surface structure comprises a laterally extending first row of mutually parallel directing elements].

3. (Twice Amended) A fluid conveying tube as claimed in claim 1, wherein each surface structure further comprises [for vehicle coolers, which on its inside comprises first and second opposite longitudinal primary heat-exchange surfaces, and flow-directing surface

structures which are arranged on the primary surfaces and which each comprise a plurality of elongate directing elements projecting from the primary surfaces, the surface structures being alternatingly arranged on the first and second primary surfaces in such manner that directing elements, succeeding in the longitudinal direction of the primary surfaces, are alternatingly arranged on the first and second primary surfaces and are mutually inclined at a given angle (γ), wherein each surface structure comprises a laterally extending first row of mutually parallel directing elements, and] a laterally extending second row of mutually parallel directing elements, the directing elements of the second row being arranged at said angle (γ) relative to the directing elements of the first row.

Please cancel claim 19.

Please cancel claim 20.

Please also add the following new claim 21:

--21. Means for effecting heat transfer in a heat exchanger, comprising:

means for introducing a plurality of partial flows into a heat exchanger tube, the tube defining a longitudinal axis and

means for imparting to each of said partial flows a swirling motion about the longitudinal axis, wherein said means for imparting said swirling motion comprises elongated directing elements on said surfaces of said tube.--